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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Kenji Hosaka et al.
Serial Number:	10/574,038
Filing Date:	March 27, 2006
Examiner/Art Group Unit:	E. Enin-Okut/1795
Title:	BIPOLAR ELECTRODE BATTERIES AND METHODS OF MANUFACTURING BIPOLAR ELECTRODE BATTERIES

APPEAL BRIEF

M.S. Appeal
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please enter the following Appeal Brief in the Appeal filed on June 22, 2010.

REAL PARTY IN INTEREST

The real party in interest is Nissan Motor Co., Ltd., a corporation organized and existing under the laws of Japan and having a principle place of business at 2 Takara-cho, Kanagawa-ku, Yokohama-shi, Kanagawa, Japan 221-0023.

RELATED APPEALS AND INTERFERENCES

There are no related prior or pending appeals, interferences or judicial proceedings known to appellant or appellant's legal representative.

STATUS OF CLAIMS

Claims 24 and 25 stand finally rejected under 35 U.S.C. § 102(b) and claims 1, 3, 7-13, 16, 18-20, 22 and 23 stand finally rejected under 35 U.S.C. § 103(a) by the Examiner as noted in the final Office Action mailed February 22, 2010 and in the Advisory Action dated June 21, 2010. Claims 2, 4, 5, 14, 15, 17 and 21 were canceled. The rejection of claims 1, 3 and 6-13, 16, 18-20 and 22-25 is appealed.

STATUS OF AMENDMENTS

There are no pending amendments. A Response after final was filed on June 1, 2010, in which claims 6 and 12 were amended. The Response was entered and considered according to the Advisory Action mailed June 21, 2010. The rejections were maintained.

SUMMARY OF CLAIMED SUBJECT MATTER

Claim 1

Claim 1 recites a battery comprising a bipolar electrode stack. The bipolar electrode stack (pg. 4, ll. 6-9, ¶[0019]) comprises a collector (Fig. 1, ref. 10; pg. 4, ll. 6-9, ¶[0019]), a cathode (Fig. 1, ref. 20; pg. 4, ll. 6-9, ¶[0019]) electrically connected to a first side of the collector (Fig. 1, ref. 10), an anode (Fig. 1, ref. 40; pg. 4, ll. 6-9, ¶[0019]) electrically connected to a second side of the collector (Fig. 1, ref. 10) and one or more layers of electrolyte (Fig. 1, 30; pg. 4, ll. 6-9, ¶[0019]) overlaying the cathode (Fig. 1, ref. 20) and anode (Fig. 1, 40). The collector comprises a high-polymer material (Pg. 5, l. 14, ¶[0025]) containing a plurality of electrically conductive particles (Pg. 5, l. 19, ¶[0026]; Fig. 2B). The cathode (Fig. 1, ref. 20) and anode (Fig. 1, 40) directly contact at least a portion of a surface of the high-polymer material of the collector. (Fig. 1). The plurality of electrically conductive particles comprises a first and second type of electrically conductive particles, wherein the first type contacts the cathode and the second type contacts the anode (Pg. 6, ll. 12-20, ¶¶[0029]-[0030]).

Claim 10

Claim 10 recites a battery module comprising a plurality of electrically connected bipolar electrode stacks (Pg. 4, ll. 6-9, ¶[0019]). Each of the bipolar electrode stacks comprises a collector (Fig. 1, ref. 10; pg. 4, ll. 6-9, ¶[0019]), a cathode (Fig. 1, ref. 20; pg. 4, ll. 6-9, ¶[0019]) electrically connected to a first side of the collector (Fig. 1, ref. 10), an anode (Fig. 1, ref. 40; pg. 4, ll. 6-9, ¶[0019]) electrically connected to a second side of the collector (Fig. 1, ref. 10), and one or more layers of electrolyte (Fig. 1, 30; pg. 4, ll. 6-9, ¶[0019]) overlaying the cathode and anode (Fig. 1, 40). The collector (Fig. 1, ref. 10) of each of the bipolar electrode stacks comprises a high-polymer material (Pg. 5, l. 14, ¶[0025]) containing a plurality of electrically conductive particles (Pg. 5, l. 19, ¶[0026]; Fig. 2B). The cathode (Fig. 1, ref. 20) and anode (Fig. 1, 40) directly contact at least a portion of the high-polymer material of the collector. The plurality of electrically conductive particles comprises

a first and second type of electrically conductive particles, wherein the first type contacts the cathode and the second type contacts the anode. (Pg. 6, ll. 12-20, ¶¶[0029]-[0030]).

Claim 12

Claim 12 recites a method for manufacturing a bipolar electrode assembly comprising forming a collector consisting essentially of an electrically conductive polymer (¶[0113], pg. 26, ll. 9-10) by applying the electrically conductive polymer in a desired form using an inkjet printing method. (Pg. 11, ll. 25-26, ¶[0051]; pg. 12, ll. 21-22, ¶[0053]). A cathode material layer is applied to a first side of the electrically conductive polymer of the collector. (Pg. 12, ll. 23-25, ¶[0053]). An anode material layer is applied to a second side of the electrically conductive polymer of the collector. (Pg. 12, ll. 25-28, ¶[0053]). A first layer of electrolyte is applied overlaying the cathode material layer, and a second layer of electrolyte is applied overlaying the anode material layer. (Pg. 12, ll. 32-33, ¶[0053]; pg. 13, ll. 1-5, ¶[0054]).

Claim 24

Claim 24 recites battery comprising a bipolar electrode stack (Pg. 4, ll. 6-9, ¶[0019]). The bipolar electrode stack comprises a collector (Fig. 1, ref. 10; pg. 4, ll. 6-9, ¶[0019]), a cathode (Fig. 1, ref. 20; pg. 4, ll. 6-9, ¶[0019]) electrically connected to a first side of the collector (Fig. 1, ref. 10; pg. 4, ll. 6-9, ¶[0019]), an anode (Fig. 1, ref. 40; pg. 4, ll. 6-9, ¶[0019]) electrically connected to a second side of the collector (Fig. 1, ref. 10; pg. 4, ll. 6-9, ¶[0019]), and one or more layers of electrolyte (Fig. 1, 30; pg. 4, ll. 6-9, ¶[0019]) overlaying the cathode (Fig. 1, ref. 20; pg. 4, ll. 6-9, ¶[0019]) and anode (Fig. 1, ref. 40; pg. 4, ll. 6-9, ¶[0019]). The collector (Fig. 1, ref. 10) consists essentially of an electrically conductive polymer (Pg. 5, l. 14, ¶[0025]; ¶[0113], pg. 26, ll. 9-10), and the cathode (Fig. 1, ref. 20; pg. 4, ll. 6-9, ¶[0019]) and anode (Fig. 1, ref. 40; pg. 4, ll. 6-9, ¶[0019]) directly contact at least a portion of a surface of the electrically conductive material of the collector.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 24 and 25 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Munshi (US 6,664,006);
2. Claim 24 stands rejected under 35 U.S.C. § 102(b) as being anticipated by

Fukuzawa et al. (JP 2004-179053);

3. Claims 1, 3, 8, 10-13, 16, 18-20, 22 and 23 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Munshi (US 6,664,006) in view of Hisamitsu et al. (US 2004/0126655);
4. Claim 7 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Munshi (US 6,664,006) and Hisamitsu et al. (US 2004/0126655) as applied to claims 1, 3, 8, 10 and 11 and further in view of Hwang et al. (US 2005/0084760); and
5. Claim 9 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Munshi (US 6,664,006) and Hitsamitsu et al. (US 2004/0126655) in view of Usui et al. (US 6,656,232).

ARGUMENT

1. Lack of Rejection of Claim 6

The Examiner has not rejected claim 6 in the final Office Action of February 22, 2010 and again in the Advisory Action of June 21, 2010. The Examiner states in sections 4 and 7 of the final Office Action that the previous rejections of claim 6 have been withdrawn. Accordingly, the status of claim 6 is unclear. As the final Office Action is incomplete, its finality should have been withdrawn.

2. Rejections under 35 U.S.C. § 102(b)

a. Claims 24 and 25

Claims 24 and 25 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Munshi (US 6,664,006). The Examiner contends that Munshi teaches or suggests each and every element of Applicants' claims 24 and 25.

Munshi teaches the use of a metal substrate. "As a substrate for one of the above-described active electrode materials, an ultra thin metal substrate is preferably employed for assembling a thin film lithium polymer electrolyte rechargeable battery." (Col. 21, ll. 46-49). "Alternatively, the electrode/electrolyte structures may use metalized plastic or polymer substrate current collectors . . . instead of the above-described very thin metallic element." (Col. 21, line 66- col. 22, line 2). As yet another alternative, "the polymer substrate of an electrode may be impregnated with an electronically conductive element that

is inert to the active electrode and metallized on both sides of the substrate without a margin a metalized polymer substrate." (Col. 22, ll. 28-31). Applicants' claim requires that the collector consist essentially of an electrically conductive polymer. Munshi clearly describes a collector that has electrically conductive polymers metalized on both sides. Only the collector comprising a polymer that is impregnated with an electronically conductive element is referred to by Munshi in col. 22, ll. 52-53: "metallization of the impregnated polymer substrate is optional."

The Examiner states in his response to arguments in the final Office Action of February 22, 2010 that a reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill in the art, including non-preferred embodiments. Applicants agree. Munshi, considering every embodiment it discloses, clearly teaches that either a metal substrate or a metalized substrate is necessary unless the polymer is impregnated with an electronically conductive element. Alternative embodiments in Munshi would also meet these limitations. These teachings of Munshi do not fall within the scope of Applicants' claim 24, so Munshi cannot anticipate claim 24.

The Examiner states in his response to arguments in the final Office Action of February 22, 2010 that the phrase "consisting essentially of" limits the scope to the specified materials and to those that do not materially affect the basic and novel characteristics of the claimed invention. In the Advisory Action of June 21, 2010, the Examiner contends that the Applicants have not provided any discussion of "a clear indication in the specification or claims of what the basic and novel characteristics actually are."

In Applicants' response filed on June 22, 2010, Applicants noted paragraph [0025], pg. 5, ll. 14-16, which describes that by making a collector from materials including high-polymer materials, it may be possible to trim the weight of the collector and improve the energy density without reducing battery performance. Conventional collectors are made of a metal foil. However, embodiments of the present invention utilize a collector containing a high-polymer material. (¶[0021], pg. 4, ll. 17-19). Applicants' specification continues, discussing the disadvantages of metal collectors. "In the collector of a commonly-used battery which is not a bipolar electrode battery, the electric charge is transmitted through a plate which is placed on the edge part of the collector and the collector has a function of collecting the electric charge which is generated in the negative electrode in the plate, or transmitting the electric charge which is supplied from the plate to the positive electrode.

Therefore, the electric resistance of the collector that is generated in the horizontal direction (surface direction) where the electric charge moves, needs to be low and, to decrease the electric resistance in the horizontal direction, a metal foil having a certain thickness is used. As a result, the weight of the battery is increased." (¶[0022], pg. 4, ll. 22-28). The specification continues to describe the advantages of the claimed subject matter. "On the other hand, in collector 10 of the bipolar electrode battery, the electric charge generated in negative electrode 40 is directly supplied to positive electrode 20 that exists in the opposite side of collector 10. Therefore, the electric current flows in the direction of the laminated layer . . . . As a result, to decrease the electric resistance in the horizontal direction, the metal foil used in a conventional battery is not necessary. Also, since the electric resistance in the horizontal direction can be high, the thickness of the collector can be thin." (¶[0023], pg. 4, line 29-pg. 5, line 6). Therefore, the specification makes clear in at least the passages cited that the basic and novel characteristics of the claimed subject matter is the ability of the electric current to flow in the vertical direction through the collector, as shown in FIGS. 2A and 2B, rather than horizontally across the surface of a metal collector.

In Example 6, collectors with conductive particles in high polymers are compared with a collector using only a conductive high polymer (Film 9: A polyaniline film (thickness: 30 micrometers) was used as the conductive high polymer film.) (¶[0113], pg. 26, ll. 9-10). As shown in the results, Film 9 provided the lowest volume resistance in the thickness direction in Table 3, the lowest by far of the internal resistance in Table 5, low battery weight in Table 4 and the lowest ratio of the resistance of the collector to the resistance of the entire battery in Table 6. "[T]he resistance value of the collecting bodies that used the conductive high-polymer itself becomes lower (conductive high polymer film 9). Although its detailed mechanism is not clear, it is considered that, when the collector uses the conductive high polymer itself, the contact of the collector with the conductive material that constitutes the electrode material improves at the point contact of the conductive particles." (¶[0125], pg. 30, ll. 1-6). Applicants submit that the specification provides detailed discussion of "a clear indication of what the basic and novel characteristics actually are."

Accordingly, Munshi does not anticipate claim 24. Claim 25 depends from claim 24 to include all of the limitations therein. At least by its dependency, claim 25 is also not anticipated by Munshi. Applicants respectfully submit that the claims are allowable over Munshi.

b. Claim 24

Claim 24 stands rejected under 35 U.S.C. § 102(b) as being anticipated by Fukuzawa et al. (JP 2004-179053) The Examiner contends that Fukuzawa et al. teaches or suggests each and every element of Applicants' claim 24. Fukuzawa et al. teaches a collector composed of a metal powder and a resin binder that may be a conductive polymer. In paragraph [0036], to which the Examiner refers, Fukuzawa et al. states that "metal powder, such as aluminum, copper, titanium, nickel, stainless steel (SUS), and these alloys, is used as the main ingredients. It heats and comes to fabricate the charge collector metal paste which contains a binder (resin) and a solvent in this, and comes to be formed with the above-mentioned metal powder and a binder. These metal powder[s] may be used by an one-sort independent, two or more sorts may be mixed and used, and that from which the kind of metal powder differs taking advantage of the feature on a process may be further laminated to a multilayer." This does not meet the scope of claim 24, which requires that the collector consist essentially of an electrically conductive polymer.

The Examiner states in his response to arguments in the final Office Action of February 22, 2010 that the phrase "consisting essentially of" limits the scope to the specified materials and to those that do not materially affect the basic and novel characteristics of the claimed invention. In the Advisory Action of June 21, 2010, the Examiner contends that the Applicants have not provided any discussion of "a clear indication in the specification or claims of what the basic and novel characteristics actually are."

In Applicants' response filed on June 22, 2010, Applicants noted paragraph [0025], pg. 5, ll. 14-16, which describes that by making a collector from materials including high-polymer materials, it may be possible to trim the weight of the collector and improve the energy density without reducing battery performance. Conventional collectors are made of a metal foil. However, embodiments of the present invention utilize a collector containing a high-polymer material. (¶[0021], pg. 4, ll. 17-19). Applicants' specification continues, discussing the disadvantages of metal collectors. "In the collector of a commonly-used battery which is not a bipolar electrode battery, the electric charge is transmitted through a plate which is placed on the edge part of the collector and the collector has a function of collecting the electric charge which is generated in the negative electrode in the plate, or transmitting the electric charge which is supplied from the plate to the positive electrode. Therefore, the electric resistance of the collector that is generated in the horizontal direction

(surface direction) where the electric charge moves, needs to be low and, to decrease the electric resistance in the horizontal direction, a metal foil having a certain thickness is used. As a result, the weight of the battery is increased." (¶[0022], pg. 4, ll. 22-28). The specification continues to describe the advantages of the claimed subject matter. "On the other hand, in collector 10 of the bipolar electrode battery, the electric charge generated in negative electrode 40 is directly supplied to positive electrode 20 that exists in the opposite side of collector 10. Therefore, the electric current flows in the direction of the laminated layer . . . . As a result, to decrease the electric resistance in the horizontal direction, the metal foil used in a conventional battery is not necessary. Also, since the electric resistance in the horizontal direction can be high, the thickness of the collector can be thin." (¶[0023], pg. 4, line 29-pg. 5, line 6). Therefore, the specification makes clear in at least the passages cited that the basic and novel characteristics of the claimed subject matter is the ability of the electric current to flow in the vertical direction through the collector, as shown in FIGS. 2A and 2B, rather than horizontally across the surface of a metal collector.

In Example 6, collectors with conductive particles in high polymers are compared with a collector using only a conductive high polymer (Film 9: A polyaniline film (thickness: 30 micrometers) was used as the conductive high polymer film.) (¶[0113], pg. 26, ll. 9-10). As shown in the results, Film 9 provided the lowest volume resistance in the thickness direction in Table 3, the lowest by far of the internal resistance in Table 5, low battery weight in Table 4 and the lowest ratio of the resistance of the collector to the resistance of the entire battery in Table 6. "[T]he resistance value of the collecting bodies that used the conductive high-polymer itself becomes lower (conductive high polymer film 9). Although its detailed mechanism is not clear, it is considered that, when the collector uses the conductive high polymer itself, the contact of the collector with the conductive material that constitutes the electrode material improves at the point contact of the conductive particles." (¶[0125], pg. 30, ll. 1-6). Applicants submit that the specification provides detailed discussion of "a clear indication of what the basic and novel characteristics actually are."

Because Fukuzawa et al. clearly teaches that metal powder is a necessary component of the collector disclosed, Fukuzawa et al. does not anticipate claim 24. Applicants respectfully submit that the claim is allowable over Fukuzawa et al.

3. Rejections under 35 U.S.C. § 103(a)

a. Claims 1, 3, 8 and 22

The Examiner rejects claims 1, 3, 8 and 22 under 35 U.S.C. § 103(a) as being unpatentable over Munshi in view of Hisamitsu et al. (US 2004/0126655). As noted by the Examiner, Munshi does not teach or suggest the feature of independent claim 1 that the electrically conductive particles include a first type and a second type, where the first type contacts the cathode and the second type contacts the anode. However, the Examiner contends that Hisamitsu et al. does suggest this.

Hitsamitsu et al. teaches that the collecting layers can be made of different materials. "Specifically, the collecting layers may include two types of layers." (¶[0036]). "In this case, it is preferable that the fluid for forming the collecting layer 212a on the side of the positive electrode layer 211a contains carbon fine particles, and the fluid for forming the collecting layer 212c on the side of the negative electrode layer 211c contains copper fine particles. Needless to say, in this case, printer heads are required for the fluids, respectively." (¶[0046]). Accordingly, Hitsamitsu et al. teaches the use of two collector layers. The layer contacting the anode may be different from the layer contacting the cathode. However, there is no teaching or suggestion of a single layer collector comprising two different types of particles, wherein the distribution of the particles within the collector may be changed. (See Applicants' ¶[0029]).

Munshi teaches the use of an anode current collector attached to an anode and a cathode current collector attached to the cathode. (Col. 8, ll. 18-22). Accordingly, combining Hitsamitsu et al. with Munshi would suggest to one skilled in the art at the time the invention was made to use the anode and cathode collector layers of Munshi each impregnated with a different type of particle. This is not within the scope of the claim. Furthermore, one skilled in the art with the objective to make a thinner and lighter battery would not be inclined to use an additional collector layer as taught by both Munshi and Hitsamitsu et al., as this would increase the thickness and the weight of the battery. Therefore, the combination of Munshi and Hitsamitsu et al. does not teach suggest or render obvious a collector having two types of particles.

Furthermore, Hitsamitsu et al. teaches the use of a paste of copper fine particles or carbon fine particles and a solvent used for reducing viscosity of the paste to make the collectors. (¶[0046]). There is no teaching or suggestion in Hitsamitsu et al. to use

a high-polymer material, as required by the claims. Hitsamitsu et al. actually states that the polymer used in the positive and negative electrodes should be encapsulated for its stability, and so it is necessary to dissolve the microcapsules by heat treatment after the fluids are applied. (¶[0051]). To one skilled in the art, the combined teachings of Hitsamitsu et al. and Munshi would discourage the use of a polymer in the collector as having to heat the polymer microcapsules to dissolve them after application would add time and cost to Munshi's "economical and high-speed method of manufacturing." (Abstract).

Therefore, the cited combination of references does not teach, suggest or render obvious the elements of claim 1. Claims 3, 8 and 22 depend from claim 1 to include all of the limitations therein. Applicants submit that at least by their dependency from claim 1, claims 3, 8 and 22 are also not rendered obvious by the cited references. Applicants submit that claims 1, 3, 8, 10, 11, 22 and 23 are in condition for allowance.

b. Claims 10, 11 and 23

The Examiner rejects claims 10, 11 and 23 under 35 U.S.C. § 103(a) as being unpatentable over Munshi in view of Hisamitsu et al. (US 2004/0126655). As noted by the Examiner, Munshi does not teach or suggest the feature of independent claim 10 that the electrically conductive particles include a first type and a second type, where the first type contacts the cathode and the second type contacts the anode. However, the Examiner contends that Hisamitsu et al. does suggest this.

Hitsamitsu et al. teaches that the collecting layers can be made of different materials. "Specifically, the collecting layers may include two types of layers." (¶[0036]). "In this case, it is preferable that the fluid for forming the collecting layer 212a on the side of the positive electrode layer 211a contains carbon fine particles, and the fluid for forming the collecting layer 212c on the side of the negative electrode layer 211c contains copper fine particles. Needless to say, in this case, printer heads are required for the fluids, respectively." (¶[0046]). Accordingly, Hitsamitsu et al. teaches the use of two collector layers. The layer contacting the anode may be different from the layer contacting the cathode. However, there is no teaching or suggestion of a single layer collector comprising two different types of particles, wherein the distribution of the particles within the collector may be changed. (See Applicants' ¶[0029]).

Munshi teaches the use of an anode current collector attached to an anode and

a cathode current collector attached to the cathode. (Col. 8, ll. 18-22). Accordingly, combining Hitsamitsu et al. with Munshi would suggest to one skilled in the art at the time the invention was made to use the anode and cathode collector layers of Munshi each impregnated with a different type of particle. This is not within the scope of the claim. Furthermore, one skilled in the art with the objective to make a thinner and lighter battery would not be inclined to use an additional collector layer as taught by both Munshi and Hitsamitsu et al., as this would increase the thickness and the weight of the battery. Therefore, the combination of Munshi and Hitsamitsu et al. does not teach suggest or render obvious a collector having two types of particles.

Furthermore, Hitsamitsu et al. teaches the use of a paste of copper fine particles or carbon fine particles and a solvent used for reducing viscosity of the paste to make the collectors. (¶[0046]). There is no teaching or suggestion in Hitsamitsu et al. to use a high-polymer material, as required by the claims. Hitsamitsu et al. actually states that the polymer used in the positive and negative electrodes should be encapsulated for its stability, and so it is necessary to dissolve the microcapsules by heat treatment after the fluids are applied. (¶[0051]). To one skilled in the art, the combined teachings of Hitsamitsu et al. and Munshi would discourage the use of a polymer in the collector as having to heat the polymer microcapsules to dissolve them after application would add time and cost to Munshi's "economical and high-speed method of manufacturing." (Abstract).

Therefore, the cited combination of references does not teach, suggest or render obvious the elements of claim 10. Claims 11 and 23 depend from claim 10 to include all of the limitations therein. Applicants submit that at least by their dependency from claim 10, claims 11 and 23 are also not rendered obvious by the cited references. Applicants submit that claims 10, 11 and 23 are in condition for allowance.

c. Claims 12, 13, 16 and 18-20

The Examiner rejects claims 12, 13, 16 and 18-20 under 35 U.S.C. § 103(a) as being unpatentable over Munshi in view of Hisamitsu et al. Claim 12 recites a method for manufacturing a bipolar electrode assembly comprising, in part, forming a collector consisting essentially of an electrically conductive polymer by applying the electrically conductive polymer in a desired form using an inkjet printing method. Applicants have described above with respect to claim 24 how Munshi fails to teach or suggest such a

collector.

Munshi teaches the use of a metal substrate. "As a substrate for one of the above-described active electrode materials, an ultra thin metal substrate is preferably employed for assembling a thin film lithium polymer electrolyte rechargeable battery." (Col. 21, ll. 46-49). "Alternatively, the electrode/electrolyte structures may use metalized plastic or polymer substrate current collectors . . . instead of the above-described very thin metallic element." (Col. 21, line 66- col. 22, line 2). As yet another alternative, "the polymer substrate of an electrode may be impregnated with an electronically conductive element that is inert to the active electrode and metallized on both sides of the substrate without a margin a metalized polymer substrate." (Col. 22, ll. 28-31). Applicants' claim requires that the collector consist essentially of an electrically conductive polymer. Munshi clearly describes a collector that has electrically conductive polymers as being metalized on both sides. Only the collector comprising a polymer that is impregnated with an electronically conductive element is referred to by Munshi in col. 22, ll. 52-53: "metallization of the impregnated polymer substrate is optional."

Applicants further submit that Hisamitsu et al. fails to teach or suggest a collector consisting essentially of electrically conductive polymer. Hitsamitsu et al. teaches the use of a paste of copper fine particles or carbon fine particles and a solvent used for reducing viscosity of the paste to make the collectors. (¶[0046]). Accordingly, the combination fails to render the invention of claim 12 obvious. Claims 13, 16 and 18-20 depend from claim 12 to include all of the limitations therein. Applicants submit that the combination fails to render these claims obvious by at least their dependency from claim 12. Applicants respectfully submit that claims 12, 13, 16 and 18-20 are allowable over the combination.

d. Claim 7

The Examiner rejects claim 7 under 35 U.S.C. § 103(a) as being unpatentable over Munshi and Hisamitsu et al. as applied to claims 1, 3, 8, 10 and 11 and further in view of Hwang et al. (US 2005/0084760). Claim 7 depends from claim 1 to include all of the limitations therein. As described above, the combination of Munshi and Hitsamitsu et al. fails to teach or suggest each and every limitation of claim 1. Therefore, the teaching of Hwang et al. would need to suggest to one skilled in the art the recited subject matter with the

teachings of Munshi and Hitsamitsu et al. Hwang et al. fails to teach or suggest the same elements that both Munshi and Hitsamitsu et al. omit -- a collector comprising the high-polymer material containing a plurality of electrically conductive particles, wherein the plurality of electrically conductive particles comprises a first and second type of electrically conductive particles, wherein the first type contacts the cathode and the second type contacts the anode, as recited in claim 1. Therefore, Hwang et al. does not cure the deficiencies of Munshi and Hitsamitsu et al. with regard to the rejection of claim 1. At least by its dependency from claim 1, the invention of claim 7 is not rendered obvious by the cited combination.

Applicants respectfully submit that claim 7 is allowable over the cited combination.

e. Claim 9

The Examiner rejects claim 9 under 35 U.S.C. § 103(a) as being unpatentable over Munshi and Hitsamitsu in view of Usui et al. (US 6,656,232). Claim 9 depends from claim 1 to include all of the limitations therein. As described above, Munshi and Hisamitsu et al. fail to teach or suggest each and every limitation of claim 1. Therefore, the combination of Munshi, Hitsamitsu et al. and Usui et al. would need to cure those deficiencies by suggesting to one skilled in the art the recited subject matter. Usui et al. fails to teach or suggest the same elements Munshi and Hitsamitsu et al. omit -- a collector comprising the high-polymer material containing a plurality of electrically conductive particles, wherein the plurality of electrically conductive particles comprises a first and second type of electrically conductive particles, wherein the first type contacts the cathode and the second type contacts the anode, as recited in claim 1. Therefore, Usui et al. does not cure the deficiencies of Munshi and Hitsamitsu et al. At least by its dependency from claim 1, the invention of claim 9 is not rendered obvious by the cited combination.

In conclusion, the Examiner's rejections of claims 1, 3 and 6-13, 16, 18-20 and 22-25 are improper and are reversible error. Reversal of the Examiner's rejections of these claims is respectfully requested. No oral hearing is requested.

Respectfully submitted,

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APPENDIX A: Claims Appendix

1. A battery comprising:

a bipolar electrode stack comprising:

a collector,

a cathode electrically connected to a first side of the collector,

an anode electrically connected to a second side of the collector, and

one or more layers of electrolyte overlaying the cathode and anode, wherein the collector comprises a high-polymer material containing a plurality of electrically conductive particles, wherein the cathode and anode directly contact at least a portion of a surface of the high-polymer material of the collector, and wherein the plurality of electrically conductive particles comprises a first and second type of electrically conductive particles, wherein the first type contacts the cathode and the second type contacts the anode.

3. The battery of claim 1, wherein the electrically conductive particles are metal particles or carbon particles.

6. The battery of claim 1, wherein the electrically conductive polymer comprises one or more of poly aniline, polypyrrole, polythiophene, polyacetylene, polyparaphenylene, poly(phenylene)vinylene, polyacrylonitrile, and polyoxadiazole.

7. The battery of claim 1, wherein the high-polymer material exhibits a weight average molecular weight of from about 50,000 Daltons to about 1 million Daltons.

8. The battery of claim 1, further comprising an electrode extracting plate electrically connected to a side of the collector.

9. The battery of claim 8, wherein the electrode extracting plate comprises a metal foil.

10. A battery module comprising:

a plurality of electrically connected bipolar electrode stacks, wherein each of the bipolar electrode stacks comprises a collector, a cathode electrically connected to a first

side of the collector, an anode electrically connected to a second side of the collector, and one or more layers of electrolyte overlaying the cathode and anode; wherein the collector of each of the bipolar electrode stacks comprises a high-polymer material containing a plurality of electrically conductive particles, wherein the cathode and anode directly contact at least a portion of the high-polymer material of the collector, and wherein the plurality of electrically conductive particles comprises a first and second type of electrically conductive particles, wherein the first type contacts the cathode and the second type contacts the anode.

11. A battery module according to claim 10, wherein the battery module is mounted on or within a vehicle.

12. A method for manufacturing a bipolar electrode assembly comprising:

forming a collector consisting essentially of an electrically conductive polymer by applying the electrically conductive polymer in a desired form using an inkjet printing method;

applying a cathode material layer to a first side of the electrically conductive polymer of the collector;

applying an anode material layer to a second side of the electrically conductive polymer of the collector;

applying a first layer of electrolyte overlaying the cathode material layer; and

applying a second layer of electrolyte overlaying the anode material layer.

13. The method of claim 12, wherein applying the cathode material layer and anode material layer is carried out using an inkjet printing method.

16. The method of claim 12, further comprising curing the electrically conductive polymer.

18. The method of claim 12, further comprising laminating together the first electrolyte layer, the cathode layer, the collector, the anode layer, and the second electrolyte layer to form a bipolar electrode cell.

19. The method of claim 18, further comprising: forming a plurality of bipolar electrode cells in a stack; and electrically connecting each of the bipolar electrode cells to form a battery.

20. The method of claim 19, further comprising: forming a plurality of batteries; and electrically connecting the plurality of batteries to form a battery module.

22. The battery of claim 1, wherein the high-polymer material comprises one of polyethylene terephthalate, polyimide and polyamide.

23. The battery module of claim 10, wherein the high-polymer material comprises one of polyethylene terephthalate, polyimide and polyamide.

24. A battery comprising:

a bipolar electrode stack comprising:

a collector,

a cathode electrically connected to a first side of the collector,

an anode electrically connected to a second side of the collector, and

one or more layers of electrolyte overlaying the cathode and anode,

wherein the collector consists essentially of an electrically conductive polymer, and wherein the cathode and anode directly contact at least a portion of a surface of the electrically conductive material of the collector.

25. The battery of claim 24, wherein the electrically conductive polymer comprises one or more of poly aniline, polypyrrole, polythiophene, polyacetylene, polyparaphenylene, poly(phenylene)vinylene, polyacrylonitrile, and polyoxadiazole.

APPENDIX B: Evidence

NONE

APPENDIX C: RELATED PROCEEDINGS APPENDIX

NONE